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PRODUCTION OF PRIMARY PARTICLES AT THE SEA SURFACE THAT CAN FUNCTION AS CLOUD CONDENSATION NUCLEI

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ABSTRACT

As the oceans cover the vast majority of Earth's surface, marine clouds are an important contributor to Earth's radiative balance. The formation and microphysics of these clouds depends on the sizes and numbers of aerosol particles present upon which cloud drops can form. In marine environments particles that are directly produced at the sea surface provide the dominant contribution to aerosol mass concentration, but their relative contribution to aerosol number concentration is not well quantified. Knowledge of the size-dependent production flux and its dependence on parameters such as wind speed, is necessary to understand and accurately model cloud formation in the marine atmosphere. Until recently it has been thought that primary aerosol particles produced at the sea surface were not abundant relative to other aerosol particles in the radius range of several tens of nanometers, those sizes thought to be most important for cloud drop formation, but several recent formulations have been presented for the flux of these particles that suggest that they may be produced in large numbers. However, the number of particles that would be produced according to these formulations seems unrealistically high, and failure of many previous investigations to detect particles of these sizes causes concerns as to the extent to which the formulations are applicable to oceanic particle production. Here the production flux of particles with radii at formation less than a few tenths of a micrometer is discussed, with older investigations reviewed and newer formulations examined.